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SOLID WASTE CHARACTERISTICS AT THE ATLANTA STATE FARMERS' MARKET

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SOLID WASTE CHARACTERISTICS AT THE ATLANTA STATE FARMERS' MARKET

A solid waste management open-file report (SW-3tg)

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SOLID WASTE CHARACTERISTICS

AT THE ATLANTA STATE FARMERS' MARKET

This open-file report (SW-3tg) on work performed under solid waste management
training grant no. EC-00033 to Georgia Institute of Technology
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U.S. ENVIRONMENTAL PROTECTION AGENCY

1971

An environmental protection publication
in the solid waste management series (SW-3tg).

FOREWORD

This Nation is facing the ever-growing problem of how best to manage its solid wastes. Not only are present practices of solid waste storage, collection, processing, and disposal becoming inadequate, but the United States also faces a shortage of trained professional workers in the field who are equipped to deal with the problem.

To help alleviate this shortage, the U.S. Environmental Protection Agency, under authority of the Solid Waste Disposal Act (Public Law 89-272), administers a program of grants-in-aid which supports graduate-level training programs at 13 universities for approximately 65 masters' degree candidates each year. These students receive specific training in the many aspects of modern-day solid waste technology and management. Some of these training programs are located at large urban universities and center their instruction on solid wastes in the urban environment, while other programs are at schools in agricultural regions and may place their emphasis on food-processing and farm waste problems. To date, over 100 engineers have been trained at the graduate level in universities receiving support from the Federal solid waste management program.

One phase of the graduate students' training is to conduct a research project dealing with a specific aspect of solid waste management. This document reports on the results of one such research project and provides information which should be useful to others concerned with better solid waste management practices.

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Introduction

This study provided an opportunity to apply existing methods for characterizing and analyzing solid wastes generated from a commercial activity. The Atlanta State Farmers' Market was chosen because of its convenience for survey and because it provided its own collection service which simplified sample analysis and data acquisition. Since the study was coordinated with the graduate training program at Georgia Tech, samples were collected and analyzed during the winter and summer quarters of 1969 on a once-weekly basis.

General Perspective

The Atlanta State Farmers' Market is located approximately two miles south of Atlanta on Highway 133 (Thomas Road) just east of Interstate 75. (See Figure 1 and Figure 2) The present Market was constructed on a 146-acre site in 1959 at a cost of about ten million dollars. At the time of survey, it included the following equipment and facilities:

1. Thirty-two farmer's sheds providing 102,400 square feet of covered dock area and 389,120 square feet of covered loading and unloading space. There were 32 truck parking spaces under each shed.

2. Nine dealer's buildings, each 585 feet long by 100 feet wide, providing a total of 510,750 square feet of enclosed space and covered dock area including offices, modern refrigeration and storage areas.

3. Support facilities including an administration building, a barber shop, a service station and cafeteria.

4. A cannery for processing and preserving fresh fruits and vegetables

5. Rail facilities for six of the dealer's buildings.

6. Solid waste storage and collection equipment including three compactor trucks, bulk refuse storage containers and three street sweepers.

7. A gas fired incinerator

The major commodities handled at the Market include vegetables, fruits, nuts and meat products such as chickens and hams. The quantity of produce varies seasonally for the individual items. Approximately 175,000 square feet of cold storage area in the dealer's building permits a limited amount of product handling in the non-growing seasons. During 1967, $54.5 million worth of the above products were handled.

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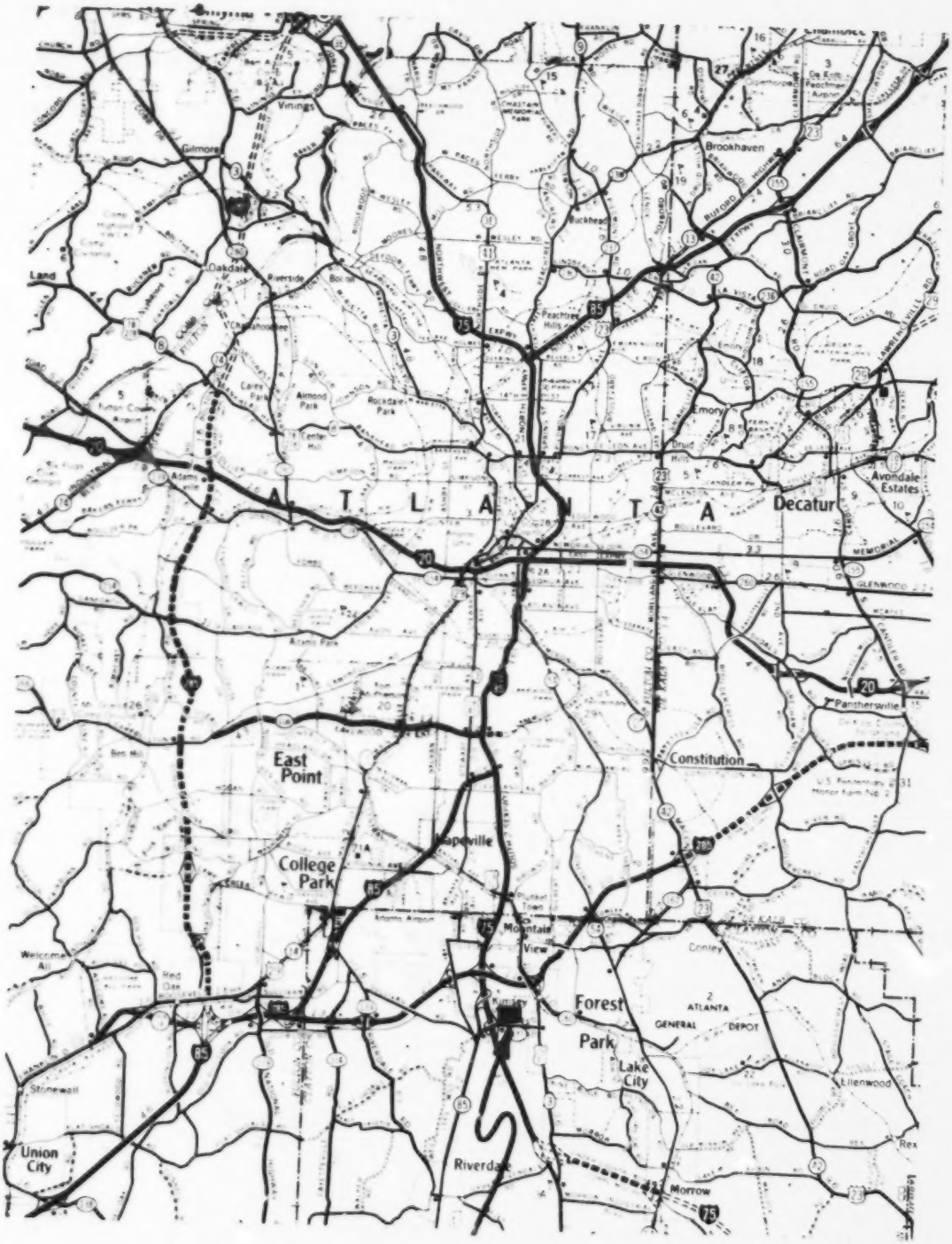
LOCATION MAP



Atlanta State Farmers' Market

Figure 1.

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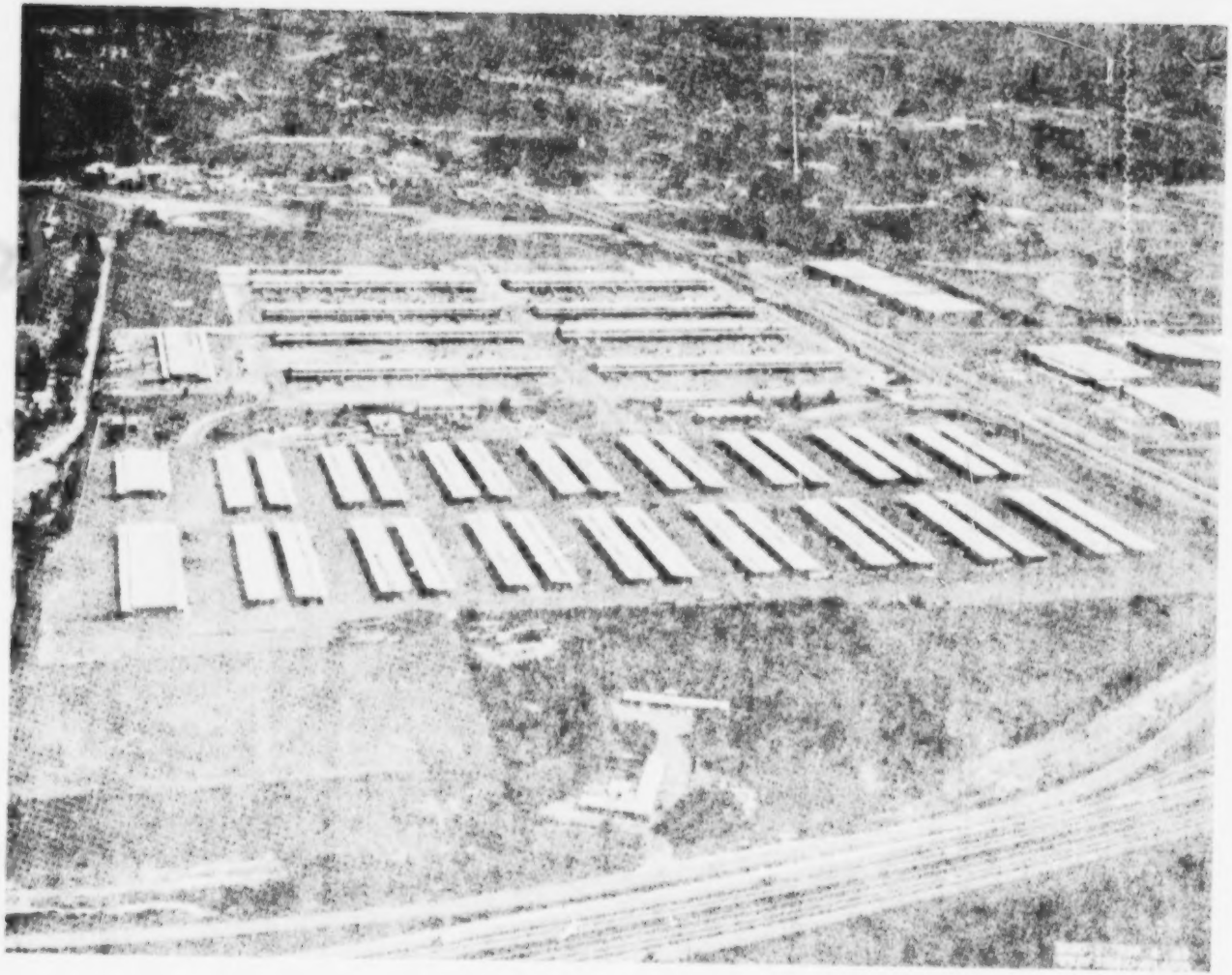

Atlanta State Farmers' Market

Figure 2.

Solid Waste Generation, Collection and Disposal

Associated with the products handled at the Market are considerable quantities of solid wastes including unsalable products, packing materials, cartons and wastes from the support facilities (offices, cafeterias, service stations, cannery, etc.). The 1968 records indicated that approximately 3580 tons or 15,876 cubic yards of wastes were generated and disposed of at a nearby landfill. Monthly fluctuations in waste quantities during 1968 are illustrated in Figure 3. It is apparent from this figure that larger quantities of wastes were handled during the local growing season when the largest quantities of produce were made available.

All wastes at the Market are collected with a modern collection system. Wastes are stored at their origin in bulk containers of which there were 90, 3-cubic yard containers and 10, 7-cubic yard containers located throughout the area during the survey period. An example of a typical container is shown in Figure 4. The containers are emptied at least once a day by Market personnel using two LoDal compactor trucks. (See Figure 5). These trucks have capacities of 25 and 18 cubic yards respectively. In addition, three Wayne, Model 970, mechanical sweepers (See Figure 6) are employed to clean the parking areas when required.

Although a gas fired incinerator is available at the Market, it is not used except to burn large wooden pallets when they are discarded. The incinerator illustrated in Figure 7 is a one ton per hour, double chamber, dual furnace, batch feed, Morse Boulger Destructor. It was installed in 1959 with the construction of the Market but was never placed into full-time operation due to mechanical control problems associated with the burning of the type of wastes generated at the Market. No plans for extended use of the incinerator had been formulated at the time of the survey.

The cannery (See Figure 8 and Figure 9) is operated as a service to Market customers. Assistance is provided by Market personnel in the operation of the processing equipment which is generally scheduled for 8-hour periods daily during the months of June through September. During 1968, approximately 76,000 No. $2\frac{1}{2}$ cans of produce were processed. The wastes from the cannery are collected along with the other Market wastes.

Essentially all solid wastes generated at the Market were disposed of at a privately owned and operated landfill located approximately three miles from the Market as illustrated by the photographs (Figure 10 and Figure 11) taken during the survey. Payment for disposal services was charged at a rate of $4.00 per load.

Sampling Procedures and Analytical Techniques

In order to obtain the necessary data to characterize the Markets' solid wastes, a routine sampling procedure was established for each seasonal period. Weekly samples were collected during a 6-weeks period in the winter

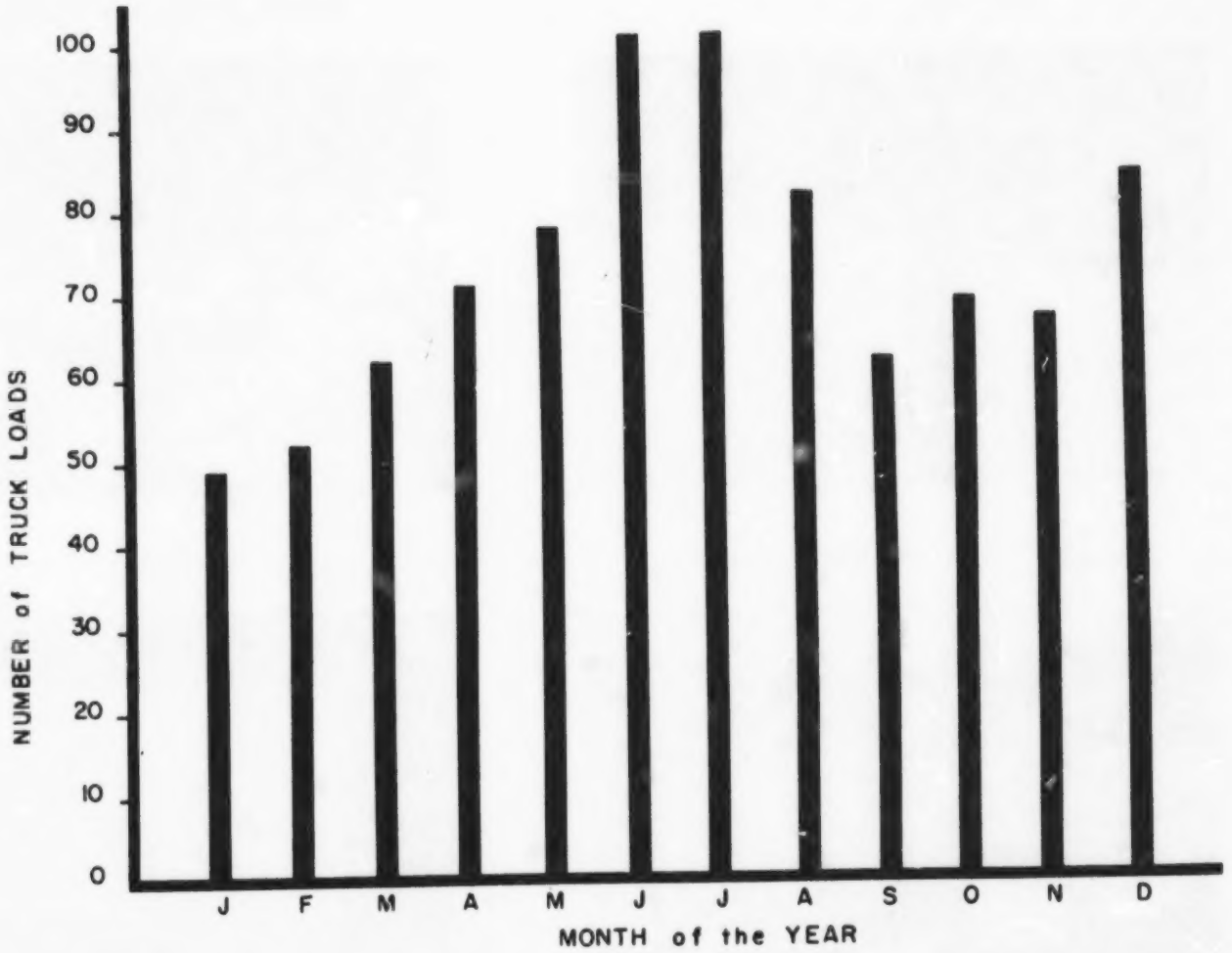

Figure 3. MONTHLY GENERATION OF SOLID WASTES BY THE ATLANTA STATE FARMERS' MARKET IN 1969

Figure 4. Bunk Container

Figure 5. Compactor Collection Truck

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Figure 6. Mechanical Sweeper

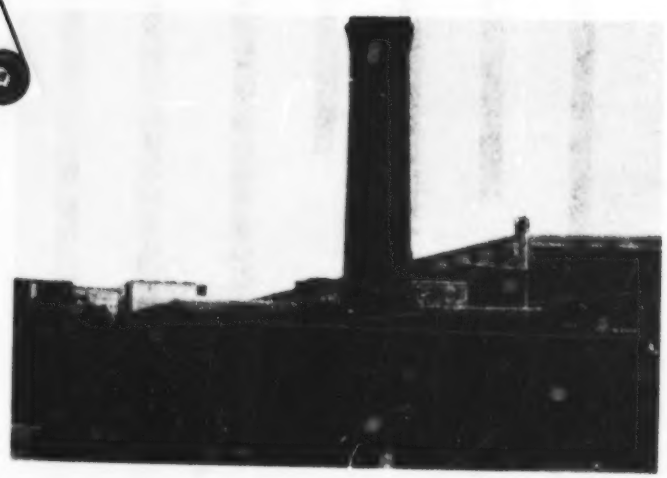

Figure 7. Incinerator

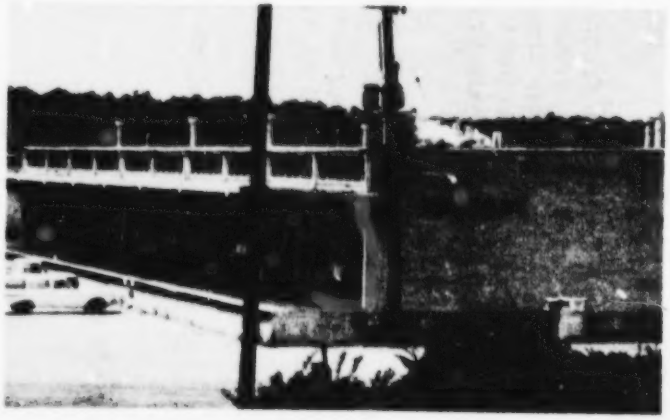

Figure 8. Cannery

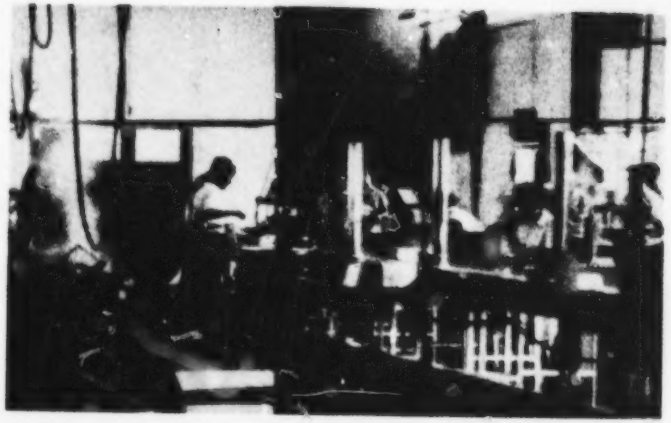

Figure 9. Canning Operation

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Figure 10. Entrance to Landfill Site

Figure 11. Landfill Site Operation

(January 23, 1969 to March 2, 1969) and a 4-weeks period in the summer (July 1, 1969 to July 30, 1969). The winter samples were collected on Thursdays and the summer samples collected on Wednesday of the respective periods. These dates were chosen to allow for coordination with the training activities at Georgia Tech.

The following procedure was followed during both sampling periods:

1. Weather conditions were recorded.

2. A compactor truck with wastes was weighed at the truck scale located at the Market.

3. The truck load was dumped at the disposal site and the load was spread with a bulldozer for sampling.

4. Visual estimates were made for fraction composition on the basis of percent volume of the major waste categories.

5. Samples by fraction were separated and returned to the laboratory at Georgia Tech for analysis.

The samples collected were analyzed in accordance with methods prescribed by Standard Methods[1] and Municipal Refuse Disposal[2]. Upon receipt of the sample fractions at the laboratory, each fraction was course ground in a Wiley Mill to a maximum size of 6 mm. after which moisture content determinations were performed using an Ohaus Moisture Determination Balance. Each fraction was then dried in a drying oven at 60°C for a period equal to or in excess of 48 hours.

After drying, volatile solids were determined on each individual fraction by ashing in a muffle furnace at 600°C. Portions of the dried course ground sample fractions were also finely ground to a particle size not greater than 0.5 mm., placed in sealed containers, indentified and stored for subsequent determinations of carbon, hydrogen and nitrogen content (F & M CHN Analyzer) and calorific value (Parr Oxygen Bomb Calorimeter).

Presentation of Data

The basic data for the samples collected during the two survey periods are presented in Tables I through IX. Table I indicates the volume, density

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1. Standard Methods for the Examination of Water and Waste Water, Twelfth Edition, APHA, 1965.

2. Municipal Refuse Disposal, Second Edition, APWA, 1966.

Table I

Volume, Density and Total Weights of Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Sample No.	Date Collected	Truck Capacity (cu.yds)	Density of Refuse (lbs/cu yd)	Total Weight (lbs)
1	1/23/69	25	635	15,900
2	1/30/69	18	545	9,820
		25	426	10,630
3	2/6/69	18	447	8,050
4	2/13/69	18	322	5,800
5	2/20/69	18	483	8,700
6	2/27/69	18	299	5,360
7	7/9 /69	25	910	22,730
8	7/16/69	25	910	22,730
9	7/23/69	25	991	24,780
10	7/30/69	18	800	14,400

Table II

Component Fractions of Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Fraction	Winter Samples (Estimated % by Volume)							Summer Samples (Estimated % by Volume)				
	1	2	3	4	5	6	Avg.	7	8	9	10	Avg.
Fruit	10	10	5	1	2	--	4.7	30	5	40	5	20.0
Vegetables	15	15	15	8	5	3	10.2	35	50	35	75	48.7
Paper	70	70	75	85	83	84.5	78.0	30	39	20	20	27.2
Wood	2	2	3	5	--	12	4.0	1	5	5	--	2.8
Burlap	3	3	--	1	--	--	1.1	--	--	--	--	--
Straw	--	--	--	--	10	--	1.6	--	--	--	--	--
Misc.	--	--	2	--	--	0.5	0 4	4	--	--	--	1.0
Fish	--	--	--	--	--	---	--	--	1	--	--	0.3
			Total				100.0			Total		100.0

Table III

Major and Minor Sub-components of Fruit and Vegetable Fractions of Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Fraction	Sub-Component	Winter Samples (by visual observation)						Summer Samples (by visual observation)			
		1	2	3	4	5	6	7	8	9	10
Fruit	Major	oranges, pineapple,	oranges apples	oranges apples	grapefruit apples	apples lemons		water-melons	water-melons	water-melons	cherries
	Minor			peas	oranges	apples		canta-loupes, peaches lemons, oranges	peaches	canta-loupes	water-melons, apples
Vegetables	Major	green onions, greens	greens	turnip greens, onions	lettuce greens	onions sweet pota-toes	turnip greens lettuce	onions, beans, lettuce	pota-toes	pota-toes onions	potatoes onions
	Minor	squash		celery, corn potatoes		cucum-ber	potatoes corn	squash, corn celery peppers	let-tuce onions, beans, cabbage	lettuce squash	peas

Table IV

Moisture Content of Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Fraction	Winter Samples (% moisture)							Summer Samples (% moisture)				
	1	2	3	4	5	6	Avg.	7	8	9	10	Avg.
Fruit	85.5	83.3	83.3	85.2	85.3	--	84.5	90.2	90.3	93.2	86.4	90.2
Vegetables	90.2	88.6	90.4	90.7	89.1	87.8	89.5	87.6	85.3	90.9	86.7	87.6
Paper	49.1	40.0	20.9	14.3	9.9	6.5	23.4	31.9	38.1	12.8	22.5	26.3
Wood	34.6	17.1	18.1	10.9	--	8.0	17.3	37.7	11.1	--	--	24.4
Burlap	21.8	25.6	--	8.2	--	--	18.5	--	--	--	--	--
Straw	--	--	--	--	13.0	--	13.0	--	--	--	--	--
Fish	--	--	--	--	--	--	--	--	77.7	--	--	77.7

Table V

Volatile Solids Content of Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Fraction	Winter Samples (% volatile solids)							Summer Samples (% volatile solids)				
	1	2	3	4	5	6	Avg.	7	8	9	10	Avg.
Fruit	95.35	92.65	96.73	97.10	97.60	--	95.90	85.18	91.10	92.15	94.30	90.68
Vegetables	84.79	73.40	83.83	82.45	92.20	89.95	84.50	88.18	94.00	93.05	91.60	91.71
Paper	97.20	94.40	97.89	98.05	98.10	99.25	97.48	88.98	99.82	98.85	95.90	96.39
Wood	98.90	99.10	99.52	99.65	--	99.35	99.30	97.65	98.80	--	--	98.22
Burlap	97.80	96.75	--	98.15	--	--	97.23	--	--	--	--	--
Straw	--	--	--	--	94.40	--	94.40	--	--	--	--	--
Fish	--	--	--	--	--	--	--	--	90.37	--	--	90.37

Table VI

Calorific Values for Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Fraction	Summer Samples (BTU/lb. on dry weight basis)							Summer Samples (BTU/lb. on dry weight basis)				
	1	2	3	4	5	6	Avg.	7	8	9	10	Avg.
Fruit	6783	6401	7274	7450	7025	--	6980	6908	6473	7175	7124	6920
Vegetables	6517	5733	6281	6635	6970	7150	6550	6882	7203	7238	7180	7126
Paper	7233	7066	7832	7360	7190	7710	7370	7427	8412	7044	7625	7628
Wood	8372	8385	8651	8220	--	8220	8350	7700	7816	--	--	7758
Burlap	7543	6974	--	7390	--	--	7302	--	--	--	--	--
Straw	--	--	--	--	8000	--	8000	--	--	--	--	--
Fish	--	--	--	--	--	--	--	--	10,110	--	--	10,110

Table VII

Carbon, Hydrogen and Nitrogen Content of Solid Waste Samples Collected from the Atlanta State Farmer' Market in 1969

Fraction	Analysis	Winter Samples (% on dry weight basis)							Summer Samples (% on dry weight basis)				
		1	2	3	4	5	6	Avg.	7	8	9	10	Avg.
Fruit	Carbon	39.20	37.20	41.30	43.90	40.70	--	40.50	37.29	39.55	42.98	41.00	40.20
	Hydrogen	6.06	6.30	6.09	6.36	4.89	--	5.94	4.66	5.48	6.68	5.91	5.68
	Nitrogen	2.89	0.96	0.99	3.99	1.33	--	2.03	1.62	2.11	4.96	1.16	2.46
Vegetables	Carbon	34.80	34.40	39.10	39.30	37.40	41.20	37.70	39.72	40.80	43.87	43.05	41.86
	Hydrogen	5.77	4.49	5.38	5.28	5.45	5.77	5.36	5.32	5.44	6.59	6.20	5.89
	Nitrogen	9.98	9.72	13.97	3.02	2.47	9.70	8.30	1.62	1.92	2.34	2.22	2.02
Paper	Carbon	42.90	44.30	47.30	47.80	47.80	47.50	46.30	43.04	44.45	45.43	41.45	43.60
	Hydrogen	6.07	6.19	6.60	6.31	6.31	6.21	6.28	6.44	6.69	6.33	6.18	6.41
	Nitrogen	0.83	0.43	0.70	0.76	0.76	1.52	0.83	0.88	0.51	0.44	0.15	0.49
Wood	Carbon	48.20	51.20	49.80	46.80	--	47.50	48.70	47.19	45.40	--	--	46.29
	Hydrogen	5.65	6.10	6.63	5.87	--	6.21	6.09	5.26	5.80	--	--	5.53
	Nitrogen	--	0.39	0.27	0.76	--	1.42	0.74	0.16	0.11	--	--	0.14
Burlap	Carbon	44.30	45.00	--	47.20	--	--	45.50	--	--	--	--	--
	Hydrogen	6.80	6.63	--	5.82	--	--	6.41	--	--	--	--	--
	Nitrogen	1.10	0.59	--	2.13	--	--	1.27	--	--	--	--	--
Straw	Carbon	--	--	--	--	46.10	--	46.10	--	--	--	--	--
	Hydrogen	--	--	--	--	6.09	--	6.09	--	--	--	--	--
	Nitrogen	--	--	--	--	1.14	--	1.14	--	--	--	--	--
Fish	Carbon	--	--	--	--	--	--	--	--	51.70	--	--	51.70
	Hydrogen	--	--	--	--	--	--	--	--	7.07	--	--	7.07
	Nitrogen	--	--	--	--	--	--	--	--	14.42	--	--	14.42

Table VIII

Statistical Variance of Analyses of Solid Waste Samples
Collected from the Atlanta State Farmers' Market in 1969

Fraction	Sample Group	Group Average with Variance		
		% Composition	% Volatile Solids	BTU/lb.(dry)
Fruit	1-6	4.7 ± 4.5	95.9 ± 2.05	6980 ± 316
	7-10	20.0 ± 17.8	90.68 ± 3.91	6920 ± 320
Vegetables	1-6	10.2 ± 5.6	84.50 ± 6.58	6550 ± 462
	7-10	48.7 ± 18.9	91.71 ± 2.55	7126 ± 166
Paper	1-6	78.0 ± 7.1	97.48 ± 1.65	7370 ± 281
	7-10	27.3 ± 9.1	96.39 ± 4.9	7628 ± 575
Wood	1-6	4.0 ± 4.2	99.30 ± 1.92	8350 ± 96
	7-10	2.8 ± 2.6	98.22 ± 0.67	7758 ± 68
Burlap	1-6	1.1 ± 1.6	97.23 ± 0.84	7302 ± 240
	7-10	--	--	--

Table IX

Statistical Variance of Analyses of Solid Waste Samples
Collected from the Atlanta Farmers' Market in 1969

Fraction	Sample Group	Group Average with Variance		
		% Carbon (dry)	% Hydrogen (dry)	% Nitrogen (dry)
Fruit	1-6	40.50 ± 2.23	5.94 ± 0.54	2.03 ± 1.21
	7-10	40.20 ± 2.4	5.68 ± 0.84	2.46 ± 1.71
Vegetables	1-6	37.70 ± 2.45	5.36 ± 0.43	8.30 ± 418
	7-10	41.86 ± 1.92	5.89 ± 0.84	2.02 ± 0.32
Paper	1-6	46.30 ± 1.93	6.28 ± 0.02	0.83 ± 0.33
	7-10	43.60 ± 1.75	6.41 ± 0.22	0.49 ± 0.30
Wood	1-6	48.70 ± 1.6	6.09 ± 0.33	0.74 ± 0.64
	7-10	46.29 ± 1.27	5.53 ± 0.38	0.14 ± 0.04
Burlap	1-6	45.50 ± 1.47	6.41 ± 0.43	1.27 ± 0.64
	7-10	--	--	--

and total weight of each truck sample evaluated. Table II and Figure 12 provide a comparison of the individual samples with respect to component fractions, Table III presents a breakdown of the component fractions with respect to major and minor sub-components, and Tables IV through VII indicate the chemical and physical analyses of these component fractions. Table VIII and IX provide analytical values obtained for the fractions based upon statistical analysis of variance.

Discussion of Data

Density and Composition of Wastes- Analyses indicated an average sample density of 451 ± 118 and 903 ± 78 pounds/cu. yd. for the winter and summer periods respectively. As indicated in Table I, there were substantial differences in weight per truck load. Since daily weighings were not available, the average weights were therefore determined on a limited number of observations. The inconsistencies noted were probably due to differences in compaction provided by the various trucks, differences in moisture content and the possibility that the trucks were not filled completely to capacity at the time of weighing.

Visual examinations and statistical calculations of the volumes of major fractions by percent of the total samples indicated considerable variance in all fractions for and between both winter and summer sampling periods. This variance was demonstrated in Table III and Table VIII and in Table II and Figure 12 on a weekly basis. As a consequence of these seasonal variations as well as normal and characteristic fluctuations in availability of all produce types, both collection and analysis of truly representative samples from the Market were somewhat hampered.

Moisture Content - As indicated in Table IV, the moisture content of the fruit and vegetable fractions was relatively consistent when the averages for the two sampling periods were compared. This could be anticipated since the water content of these fractions would not be greatly influenced by changes in meteorological conditions. The difference observed between the winter and summer averages (84.5% vs. 90.2%) could probably be attributed to changes in types of fruit and vegetables during the two sampling periods as shown in Table III and on Figure 12. The higher moisture content of watermelons and cantaloupes probably accounted for the majority of increase for the summer samples.

The moisture content of the paper, wood and burlap fractions (Table IV) varied primarily according to weather conditions at the time of sampling and to some extent with the types of produce with which these fractions had come into contact either during shipment, storage or compaction in the collection vehicles. For example, the first three winter samples (1,2 & 3) were collected during either light or relatively heavy rainfall. Sample 4 was obtained during relatively dry weather but with a heavy cloud cover with high humidity. The remaining winter samples (5 & 6) were obtained during fair and dry weather. Similarly, the first three summer samples (7, 8 & 9) were collected in cloudy and rainy weather whereas Sample 10 was obtained on a hot and dry day.

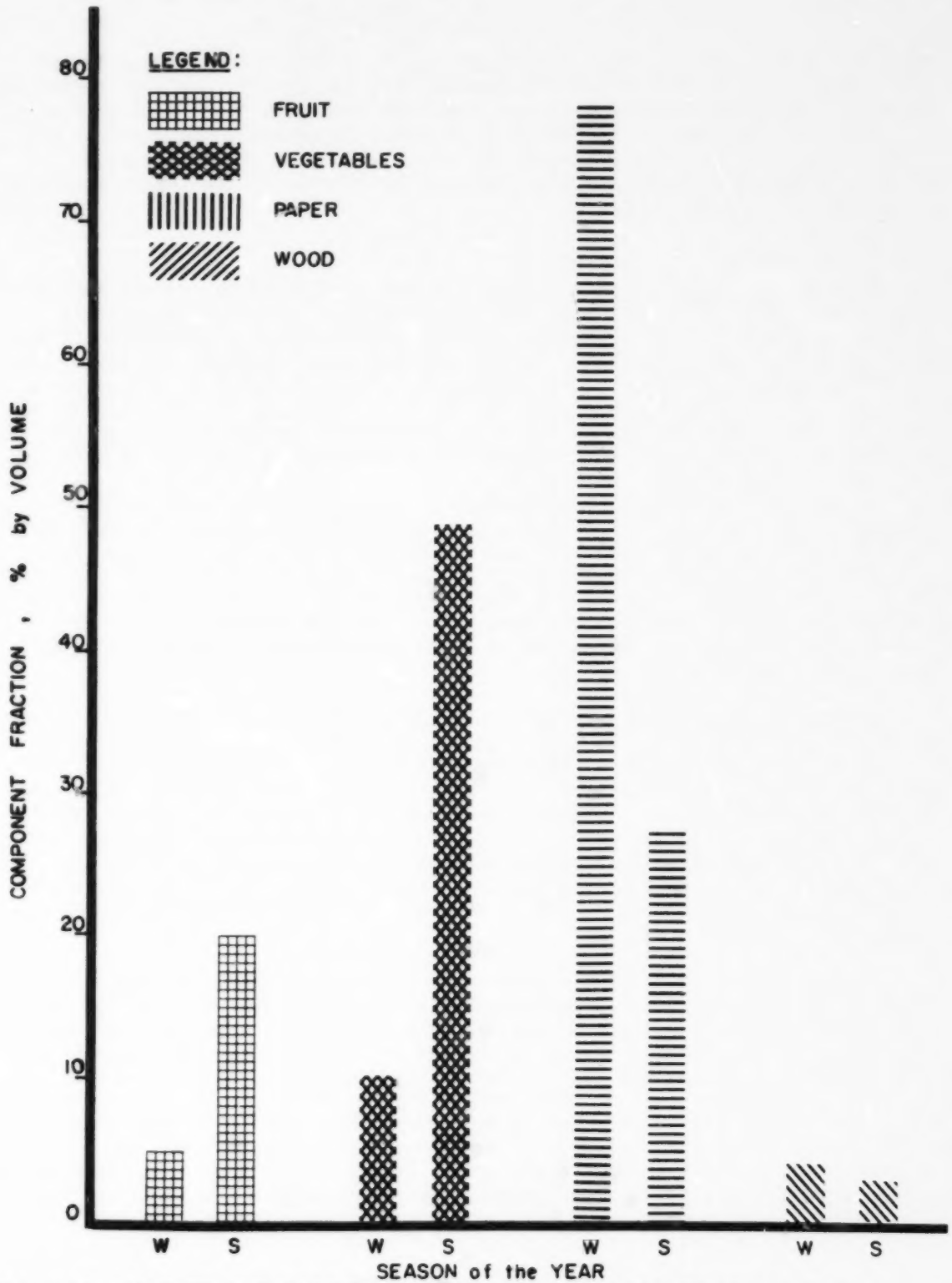

Figure 12. WINTER AND SUMMER VARIATIONS IN MAJOR FRACTIONS OF SOLID WASTE SAMPLES COLLECTED AT THE ATLANTA STATE FARMERS' MARKET IN 1969

It appeared that the moisture contents of these latter samples were also influenced by the type of produce associated with these fractions during shipment and storage.

Volatile Solids - The volatile solids content of the fruit and vegetable fractions of each sample obtained during the winter and summer sampling periods were relatively consistent (Table V and Table VIII). The small variance noted could probably be attributed to some finite quantity of non-combustible matter such as sand or silt which may have been collected with the sample fractions. These materials would also influence the analysis of vegetable fractions of certain produce grown on or in the ground such as lettuce, turnips, etc. which were more prevalent during the winter sampling period than the summer (Table III).

The volatile content of the paper, wood and burlap fractions were even more consistent during both the winter and summer sampling periods. The only exception was Sample 7 collected during the summer when the landfill area was particularly muddy. As a consequence, some of the mud or other non-combustibles were probably collected with these fractions after the load had been spread for inspection and sampling at the landfill site. This effect was more noticeable for those fractions which constituted the larger portion of the total sample collected, i.e. paper, fruit and vegetables (Table II).

Calorific Value - As indicated in Table VI, the calorific values of all fractions were determined on a moisture free basis. There was not a significant difference in the average values for the fruit and vegetable fractions collected either in the winter or the summer and the variance noted (Table VIII) could probably be attributed to some difficulty in obtaining representative samples for analysis, the presence of small quantities of non-combustibles and the changes in components of the individual fractions (Table II).

The calorific values for the paper, wood and burlap fractions were also relatively consistent with somewhat higher values for the wood in the winter than in the summer. It is possible that a different type of wood packing material was used each season which could have accounted for this variation. A slight increase in calorific values for the paper fractions during the summer could also have reflected the greater amount of non-combustibles which may have been unintentionally collected with the paper fractions during wet weather particularly associated with the winter sampling period.

Carbon, Hydrogen and Nitrogen Content - A review of the data presented in Table VII indicated that the CHN content of each sample fraction was relatively constant during both the winter and summer sampling periods as were the average percent variance as shown in Table IX with the exception of a higher nitrogen content exhibited by the vegetable fraction during the winter. This exception could probably be attributed to the differences in types of vegetables handled in each season of the year. For example, the principle types of vegetables handled

during the winter, particularly for Samples 3 and 6 of Table VII, were the green leafy variety such as greens and cabbage in addition to green onions in which the collective nitrogen content was determined to be relatively high. Conversely, the vegetables handled during the summer periods included potatoes and starchy vegetables in which the nitrogen content was collectively lower. Moreover, as shown in Table III, the green leafy types of vegetables were not present in significant quantities in any of the summer samples.

A less dramatic increase in carbon content of the vegetable fractions during the summer was also noted. This increase corresponded to the increase in calorific value of the vegetable fraction (Table VI) as well as its volatile content (Table V) in the summer. As noted previously, these increases were probably associated with the differences in types of vegetables handled during each season (Table III).

Summary and Conclusions

The data reported herein provides some insight into the quantity and characteristics of the solid wastes generated at the Atlanta State Farmers' Market during two seasons of the year. Division of the sample collected during each week of the respective sampling periods into major fractions also provided additional information concerning relative quantities and physical and chemical characteristics of these fractions.

Although it would have been desirable to have collected samples each day rather than once a week, some estimate of the nature of the entire quantity of solid waste generated during the two sampling periods could be made with the data available. Accordingly, composite figures for each sampling period were determined as recorded in Table X and Table XI. These determinations were made by taking the ratios of the moisture content and correlating them with the estimated volumes, calculated densities and the truck load weights to yield the weight of moisture in each sample fraction. The dry weight was then calculated and correlated with the volatile solids, the carbon, hydrogen and nitrogen content and the calorific value determinations. The moisture content for each sample was determined on a gross weight basis and tabulated in Table X together with the volatile solids content. The CHN values for each sample were corrected for ash content and recorded on a moisture and ash free (MAF) basis.

The volatile solids content for each survey period was then calculated on a gross weight basis from the data in Table X and recorded in Table XI together with the other analyses as indicative of the composite samples collected during the winter and summer sampling periods. These data are also illustrated graphically in Figure 13 and could be considered representative of the probable characteristics of solid wastes generated at the Atlanta State Farmers' Market or a similar operation during the winter and summer seasons.

Table X

Composite Characteristics of Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Average Analysis	Winter Samples							Summer Samples				
	1	2	3	4	5	6	Composite	7	8	9	10	Composite
Moisture (%, gross weight)	63.75	59.70	67.30	44.20	40.88	30.05	52.70	80.48	67.55	86.37	82.65	79.12
Volatile Solids (%, dry weight)	94.98	93.00	96.40	97.20	95.87	98.90	96.00	85.79	97.70	94.55	92.86	93.50
Calorific Value (BTU/lb., MAF)	7550	7350	7960	7540	7960	7880	7613	8500	8190	7720	7870	8132
Carbon (%, MAF)	45.2	46.4	48.1	48.5	48.6	47.9	47.17	48.80	45.35	47.15	45.05	46.56
Hydrogen (%, MAF)	6.39	6.54	6.70	6.43	6.42	6.27	6.44	6.33	6.24	6.62	6.57	6.36
Nitrogen (%, MAF)	1.56	0.89	1.97	0.95	1.03	1.96	1.36	1.25	3.90	2.08	1.27	2.53

Table XI

Summary of Composite Characteristics of Solid Waste Samples Collected from the Atlanta State Farmers' Market in 1969

Sample	Calorific Value (BTU/lb).		Moisture Content (%, gross weight)	Volatile Solids (%, gross weight)	Ash Content (%, gross W	CHN Content (%, MAF)		
	MAF	As Sampled				Carbon	Hydrogen	Nitrogen
Winter	7613	3450	52.70	45.31	1.99	47.17	6.44	1.36
Summer	8132	1585	79.12	19.50	1.38	46.56	6.36	2.53

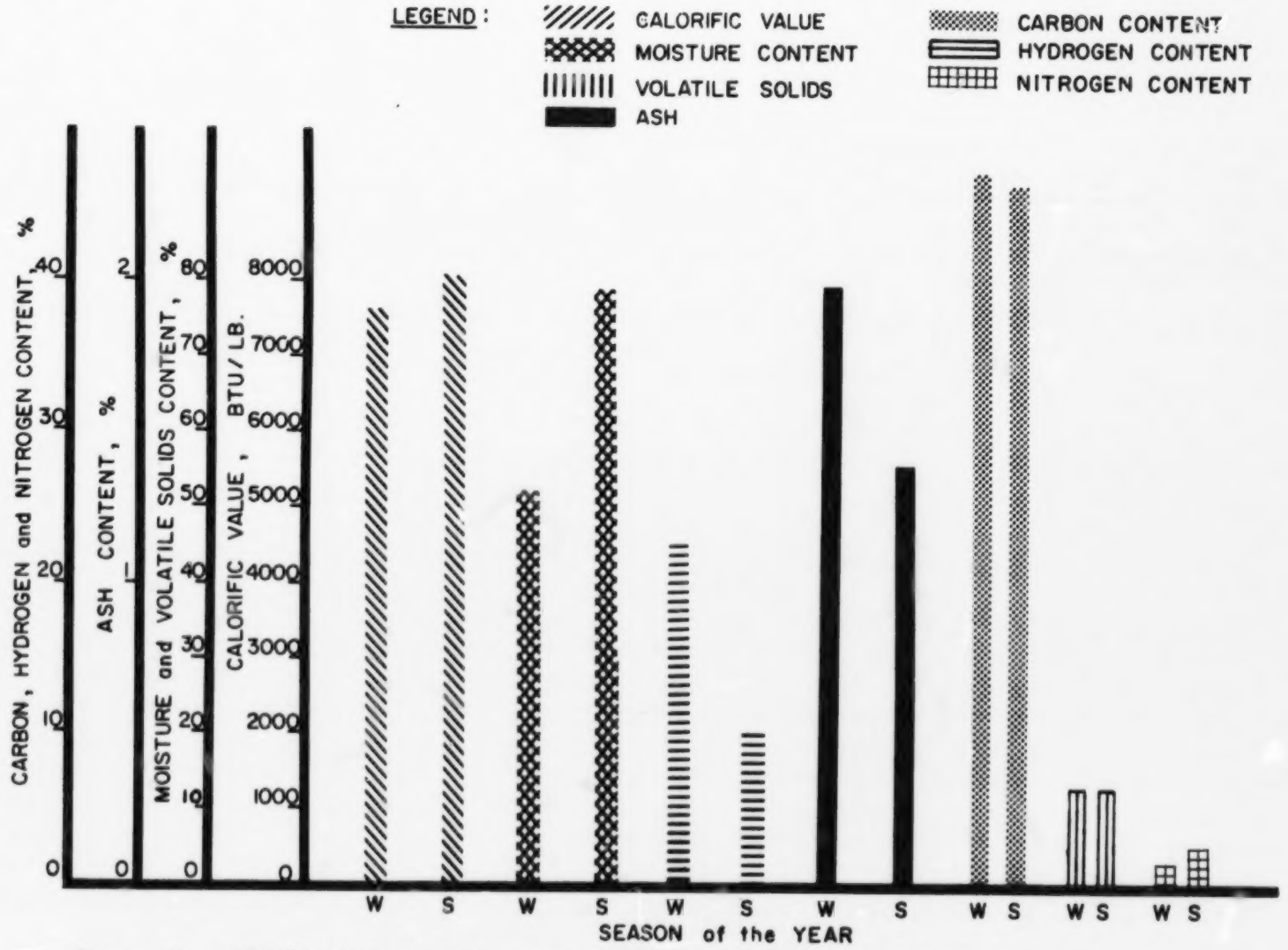

Figure 13 WINTER AND SUMMER VARIATIONS IN COMPOSITION OF SOLID WASTE SAMPLES COLLECTED FROM THE ATLANTA STATE FARMERS' MARKET IN 1969

Based upon the results of these analyses and experiences associated with the surveys conducted in the winter and summer of 1969, it can be concluded that:

1. The major source of difficulty in obtaining representative samples for analysis and characterization was establishing an adequate collection and fraction identification method. Visual estimation of volumes of fractions of weighted quantities was probably less than desirable but yielded calculated densities which were comparable to sample values with similar moisture contents recorded elsewhere.

2. Changes in meteorological conditions coupled with the types of produce in contact with the paper and other rubbish fractions during shipment, storage and handling will greatly influence moisture content. Identification of the sub-components of the product (particularly of the fruit and vegetable fractions) to be handled as well as prevailing weather conditions is important for proper interpretation of moisture content determinations.

3. Changes in type and character of produce handled during different seasons of the year must be included during evaluation of physical and chemical analyses of both composite and individual fractions. Such changes will not only be reflected in the moisture, volatile solids, calorific value and CHN content of the product fractions but also in the analyses performed on the paper and other rubbish fractions. Variability in character of individual fractions will often be masked in composite analysis through averaging of effects.

4. The variations in character of solid wastes originating from the Atlanta State Farmers' Market can be described on the basis of routine analytical procedures. The wastes are relatively high in organic (combustible) and moisture content which would allow for their disposal either by incineration after some preliminary drying or by biological treatment in a sanitary landfill or composting operation. Sanitary landfill disposal was considered to be the most applicable procedure under the circumstances prevailing during the survey periods.

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